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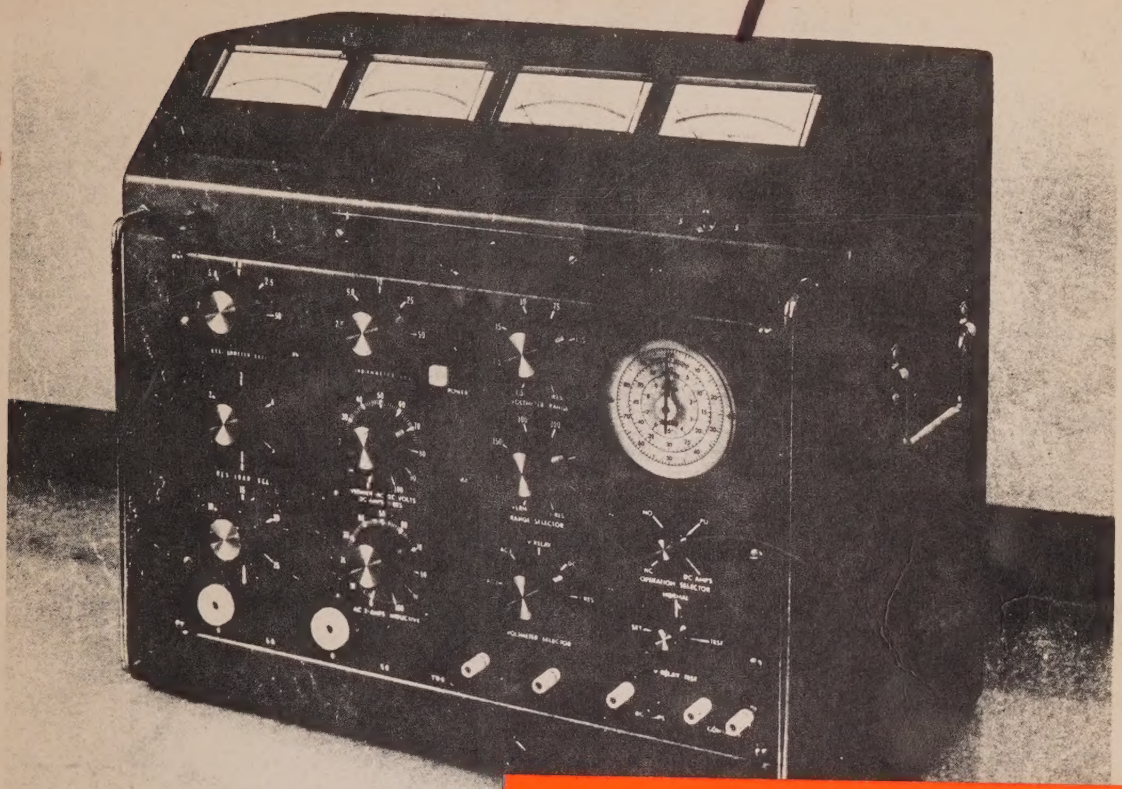
GE TEST



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PROTECTIVE RELAY TEST UNIT

MODEL PR-71

INSTRUCTION MANUAL

GEK-32004

GENERAL ELECTRIC
INSTRUMENTATION & CONTROL SERVICE
11223 SOUTH HINDRY AVE.
LOS ANGELES, CALIFORNIA 90045
PHONE (213) 642-5350

GENERAL ELECTRIC

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PROTECTIVE RELAY
TEST UNIT

MODEL PR-71
INSTRUCTION MANUAL
GEK-32004

MANUFACTURED BY:
GENERAL ELECTRIC COMPANY
INSTRUMENTATION & CONTROL SERVICE
2379 JOHN GLENN DRIVE
CHAMBLEE, GEORGIA 30341

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GENERAL ELECTRIC

MODIFICATIONS FOR PROTECTIVE RELAY TEST UNIT

MODEL PR-71 - INSTRUCTION MANUAL GEK-32004

REFERENCE OPERATION SECTION

ITEM NO.

1) RES. AMMETER:

Standard ranges are 1.0, 2.5, 5.0, 10.0, 25.0 and 50 Amperes AC.
(1.0 Amp. Range Added)

2) RELAY PICK-UP INDICATOR LIGHT:

An additional light has been added for use when two separate sets of contacts are monitored. Lights are labled PU#1 and PU#2. PU#1 operates from contacts #1 terminals, which are not selective. PU#2 operates from contacts #2 terminals when operation selector is in the PU position.

7) VERNIER AC-DC VOLTS, DC AMPS:

a) There are two (2) Amperes of control with the Vernier.
c) DC Amps. (0-5A) at the contacts #2 terminals when the Operations Selector is in the DC position and the Range Selector is in the 15 position.

13) DC AMMETER:

Standard ranges os 0.5 to 5.0 Amps. DC - used to monitor the DC Amps as contacts #2 terminals.

20) OPERATION SELECTOR:

Selects the mode of operation for the PR-71 using contacts #2.
d) DC Amps - when DC Amps 0-5 is desired from the contacts #2 terminals to test seal-in units.

25) CONTACTS #1:

Terminals for PU#1 continuity tests.

26) CONTACTS #2:

Terminals for connecting external relay contacts for continuity tests, relay time calibrations and for DC Amps when testing seal-in units.

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GENERAL ELECTRIC

MODIFICATIONS FOR PROTECTIVE RELAY TEST UNIT

MODEL PR-71 - INSTRUCTION MANUAL GEK-32004

REFERENCE APPLICATIONS SECTION

GENERAL INFORMATION:

Test set-up for ICW-52B is wrong. Studs 7 & 8 are connected to the inductive current terminals and should be connected to potnetial, AC-2 terminals.

GENERAL INFORMATION

The Model PR-71 Protective Relay Test Unit is designed for laboratory and field use in the repair and calibration of protective relays. Protective relays are used in industrial and utility facilities to monitor electrical power generation and distribution circuits. The Model PR-71 Test Unit uses resistive loading to effect the testing and calibrating of these protective relays. Resistive loading eliminates current distortion and the need for correction curves required by test sets using inductive loading methods. Protective relay manufacturers use resistive loading in the manufacturing process to calibrate these relays. These manufacturers maintain that resistive loading is the only accurate means of calibrating protective relays. Corrective curves used with inductive loading test sets have not been developed sufficiently to provide a comparable level of accuracy.

In addition to the resistive loading within the Model PR-71 test unit inductive loading and AC and DC power sources are available for those relays that do not require resistive loading or relays that require more than one power source. This multiple power source capability expands the use of the Model PR-71 into a portable power supply for use in testing and calibrating other electrical devices including molded case circuit breakers, wire insulation resistance, switchboard instruments such as AC/DC voltmeters and ammeters and AC wattmeters, and AC/DC recorders.

The Model PR-71 Protective Relay Test Unit is a member of the GETEST* family of maintenance, laboratory, and production test equipment.

*Trademark of the General Electric Company

The following are the key features and benefits of the Model PR-71 Test Unit.

Resistive loading eliminates the need for correction curves and increases accuracy.

Elapsed time indicator permits automatic timing of relay pickup.

Single unit, light weight design reduces setup and testing time.

500 volt DC power source allows insulation testing.

Four additional power source outputs are provided: 0-100 amps AC, 0-140 volts AC, 0-300 volts AC/DC, 0-5 amps DC.

Field or bench testing capability.

Flexibility in testing virtually all protective relays.

SPECIFICATIONS

MODEL PR-71
PROTECTIVE RELAY TEST UNIT

RESISTANCE LOAD OUTPUT

- 0 to 30 amps at 120 volts A. C.
- Adjustable load in increments of 1. 0 amps with a 1. 0 amp vernier control
- Ammeter ranges (standard): 1. 0, 2. 5, 5. 0, 10, 50 amps (optional ranges available)
- Duty cycle: 30 minutes "on"; 30 minutes "off"

INDUCTANCE LOAD OUTPUT

- 0 to 50/100 amps A. C. at 250 watts, max.
- Continuously adjustable
- Ammeter ranges standard): 2. 5, 5. 0, 10, 25, 50/100 (optional ranges available)
- Duty cycle: continuous

AC-2 OUTPUT

- 0 to 140 volts A. C. at 4. 5 amps, max.
- Continuously adjustable
- Voltmeter ranges: 1. 5, 7. 5, 15, 30, 75, 150, 300 volts

AC-3 OUTPUT

- 0 to 300 volts A. C. or D. C. at 250 ma, max.
- Continuously adjustable
- Voltmeter ranges: 1. 5, 7. 5, 15, 30, 75, 150, 300 volts
- 500 volt insulation resistance source; limited at 1. 0 ma, 10 megohm

DC AMPS OUTPUT

- 0 to 5. 0 amps D. C. at 10 volts
- Continuously adjustable
- Ammeter ranges: 0. 5 to 5. 0 amps

INPUT POWER

- 120 volts A. C.
- 30 amps, min.
- 60 hertz
- Single phase

TIMER

- Elapsed time: 0. 01 seconds to 10 minutes
- Clock resolution: 0. 01 seconds

METERS

- Accuracy: 1 percent of full scale, all instruments
- Mirrored scales, all instruments

MECHANICAL CHARACTERISTICS

- Overall dimensions: depth 12", width 25", height 20"
- Net weight: 75 pounds
- Ambient operating temperature: 0^{o} to 55^{o} C
- Fan cooled enclosure
- Welded aluminum case

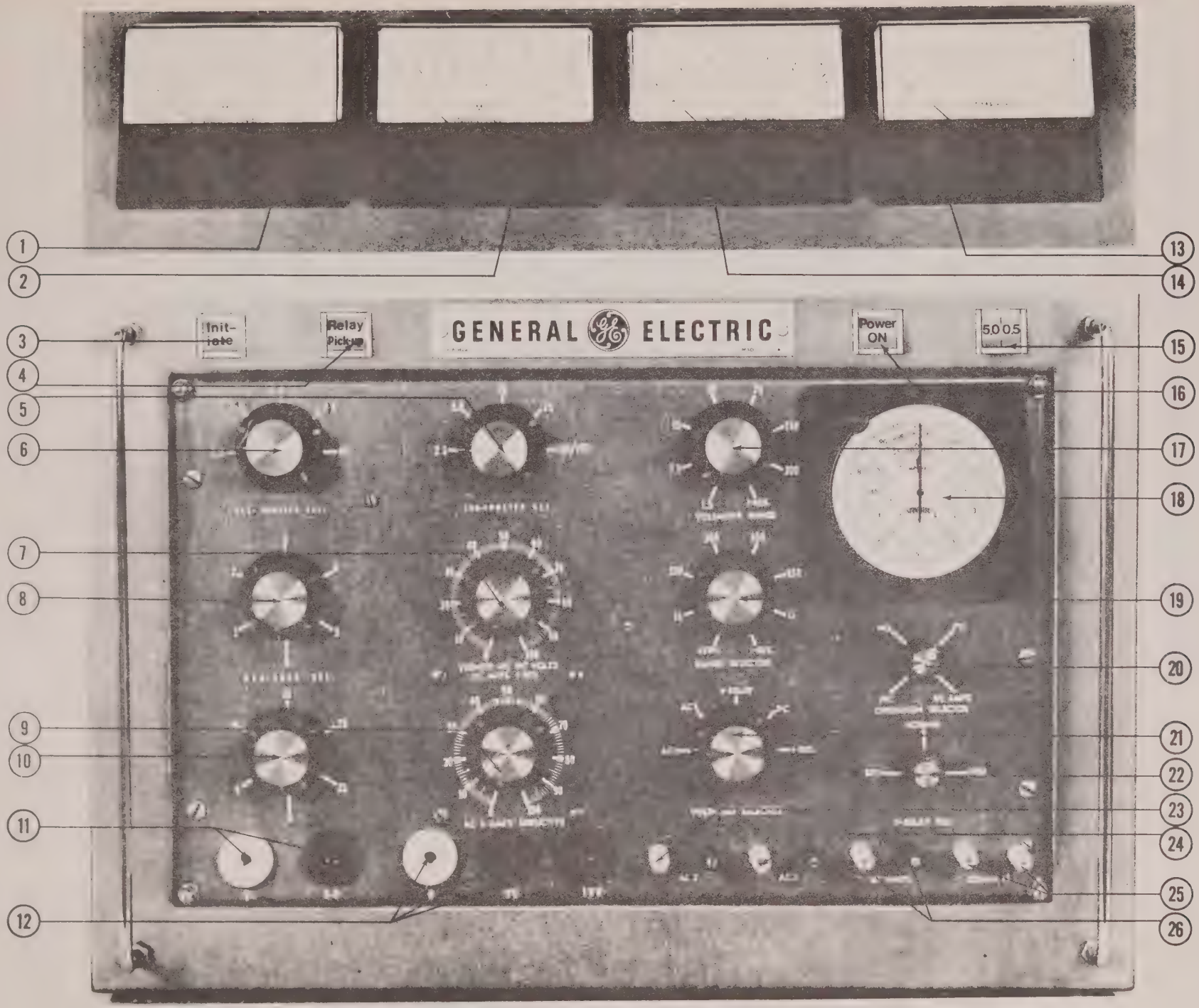
WARRANTY

The Company warrants to the Purchaser that the equipment to be delivered hereunder will be free from defects in material or workmanship and will be of the kind and quality designated or specified in the contract.

This warranty shall apply only to defects appearing within one year from the date of shipment by the Company. If the Company installs the equipment or supplies technical direction of installation by contract, the warranty period shall run from the completion of installation, provided same is not unreasonably delayed by the Purchaser. The conditions of any tests shall be mutually agreed upon and the Company shall be notified of, and may be represented at, all tests that may be made.

If the equipment delivered hereunder does not meet the above warranty, and if the Purchaser promptly notifies the Company, the Company shall thereupon correct any defect, including nonconformance with the specifications, either (at its option) by repairing any defective or damaged parts of the equipment, or by making available at the Company's plant necessary repaired or replacement parts. The liability of the Company under this warranty (except as to title), or for any loss or damage to the equipment whether the claim is based on contract or negligence, shall not in any case exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of the warranty period all such liability shall terminate. The foregoing shall constitute the exclusive remedy of the Purchaser and the exclusive liability of the Company.

The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory (except as to title). NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PURPOSE SHALL APPLY. The Company does not warrant any equipment of other manufacture designated by Purchaser.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26
Init-iate
Relay Pickup
GENERAL ELECTRIC
Power ON
5005

DESCRIPTION OF OPERATING DEVICES

1. RES. AMMETER

   Standard ranges of 1, 2.5, 5.0, 10.0, and 50 Amps. AC. This ammeter is used to monitor the AC output current from the RES. OUTPUT TERMINALS. True R.M.S. current is read on this moving vane type instrument.

2. IND. AMMETER

   Standard ranges of 2.5, 5.0, 10.0, 25.0, and 50.0 Amps. AC. This ammeter is used to monitor the AC output current from the IND. OUTPUT TERMINALS. In addition the 100 Amp. output is also monitored on this instrument when the IND. AMMETER SEL. is in the 50 Amp. position. True R.M.S. current is read on this moving vane type instrument.

3. INITIATE PUSHBUTTON

   Initiates all control circuits in the Model PR-71 test unit and must be pressed for all outputs.

4. RELAY PICK-UP INDICATOR LIGHT

   This is a continuity light which comes on when the CONTACTS are closed and the OPERATION SELECTOR is in the PU position.

5. IND. AMMETER SEL.

   Selects the appropriate range for the IND. AMMETER. This selector switch must be in the 50/100 position when using the 100 Amp. output terminal.

6. RES. AMMETER SEL.

   Selects the appropriate range for the RES. AMMETER.

7. VERNIER AC-DC VOLTS, DC AMPS.

   Provides continuous control of 4 functions as follows:

a) Vernier control of resistance load current to the RES. OUTPUT TERMINALS when RANGE SELECTOR is in the VERN. position. There is approximately 1 ampere of control with this potentiometer.

b) AC-DC Volts (0 to 300V) at AC-3 OUTPUT TERMINALS when the VOLTMETER SELECTOR is in the AC-2 position.

c) DC Amps. (0 to 5A) at the CONTACTS when the OPERATIONS SELECTOR is in the DC Amps. position and the VOLTMETER SELECTOR is not in the VERN. position.

d) Insulation resistance (0 to 10 megohms) at 500 V. D. C. and limited to 1 ma. at fault using the AC-3 OUTPUT TERMINALS. Adjustment of VOLTMETER zero is made by shorting the AC-3 OUTPUT TERMINALS and rotating the VERNIER-AC DC VOLTS DC AMPS. control until zero is reached. The RANGE SELECTOR and VOLTMETER SELECTOR must be in the I-RES position.

8. &10. RES. LOAD SEL. (S)

Switches the output current in 1 or 5 Amp. steps to the RES. OUTPUT TERMINALS. These are not precision output switches but rather a coarse adjustment only. Actual output current is shown on the RES. AMMETER and vernier adjustment is made with the VERNIER-AC-DC VOLTS-DC AMPS. control when the RANGE SELECTOR is in the VERN. position.

9. AC2 - AMPS INDUCTIVE CONTROL

Controls the inductive loaded output current (0 to 50/100A) at the IND LOAD TERMINALS and the (0 to 140 V. A. C.) to the AC2 OUTPUT TERMINALS.

11. RES. OUTPUT TERMINALS

Output is provided at these terminals from the resistance loading circuit. Output capacity is determined by the current available to the PR-71. However a 30 Amp. design limit has been determined with higher outputs available on other models.

20. OPERATION SELECTOR

Selects the mode of operation for the PR-71 test unit. Operating modes are:

a) NC - when operating test unit on relays or control devices with normally closed contacts. All outputs will be shut off when CONTACTS terminals are opened and OPERATION SELECTOR is in NC position.

b) NO - when operating test unit on relays or control devices with normally open contacts. All outputs will be shut off when CONTACTS terminals are closed and OPERATION SELECTOR is in NO position.

c) PU - when operating test unit on relays or control devices and pick up or closure of an external contact must be known. The RELAY PICK-UP light will come on when the CONTACTS terminals are closed. This position is also used when maintained output currents are desired.

d) DC Amps. - when DC Amps. 0 to 0.5/5 is desired from the DC AMPS. OUTPUT TERMINALS to test Relay Seal-in units.

21. VOLTMETER SELECTOR

Selects the circuit the VOLTMETER is to monitor.

22. V-RELAY TEST SWITCH

Provides a convenient switching arrangement to test voltage relays. Fault voltage and normal voltage to the relay is provided at the AC3 OUTPUT TERMINALS and monitored on the VOLTMETER.

When this switch is in the SET position, the fault voltage is adjusted by the VERNIER-AC DC VOLTS DC AMPS control. In the NORMAL position the normal relay operating voltage is adjusted by the AC2 AMPS INDUCTIVE CONTROL. When the switch is brought to the TEST position the preadjusted fault voltage is reapplied to the relay and the TIMER starts.

23. AC2 OUTPUT TERMINALS

Output is provided at these terminals from the primary of the inductive loading circuit and is 0 to 140 V. A. C. at 4.5 Amps. max.

24. AC3 OUTPUT TERMINALS

0 to 300 Volts A. C. or D. C. at 250 ma. max. plus an additional 500 V. D. C. for insulation resistance testing.

25. CONTACTS

Terminals for connecting external relay contacts to the Model PR-71 tester for continuity tests and relay time calibrations. When the OPERATION SELECTOR is in the DC position, the DC AMPS. OUTPUT is transferred to these terminals. This eliminates the necessity to transfer leads when testing seal-in units on some relays.

26. DC AMPS. OUTPUT TERMINALS

Output is provided here to test relay seal-in circuits and produces 5 Amps. DC at 10 Volts maximum. When the OPERATION SELECTOR is in the DC Amps. position control of output is made with the VERNIER AC DC VOLTS DC AMPS. control.

GENERAL INFORMATION

The relay test set-ups shown in this section are typical of the relays that can be tested with the Model PR-71 Protective Relay Test Unit. It is not intended that the use of this Test Unit be restricted to these relays. Most protective relays of any manufacture can be tested with the Model PR-71 Test Unit using similar test set-ups.

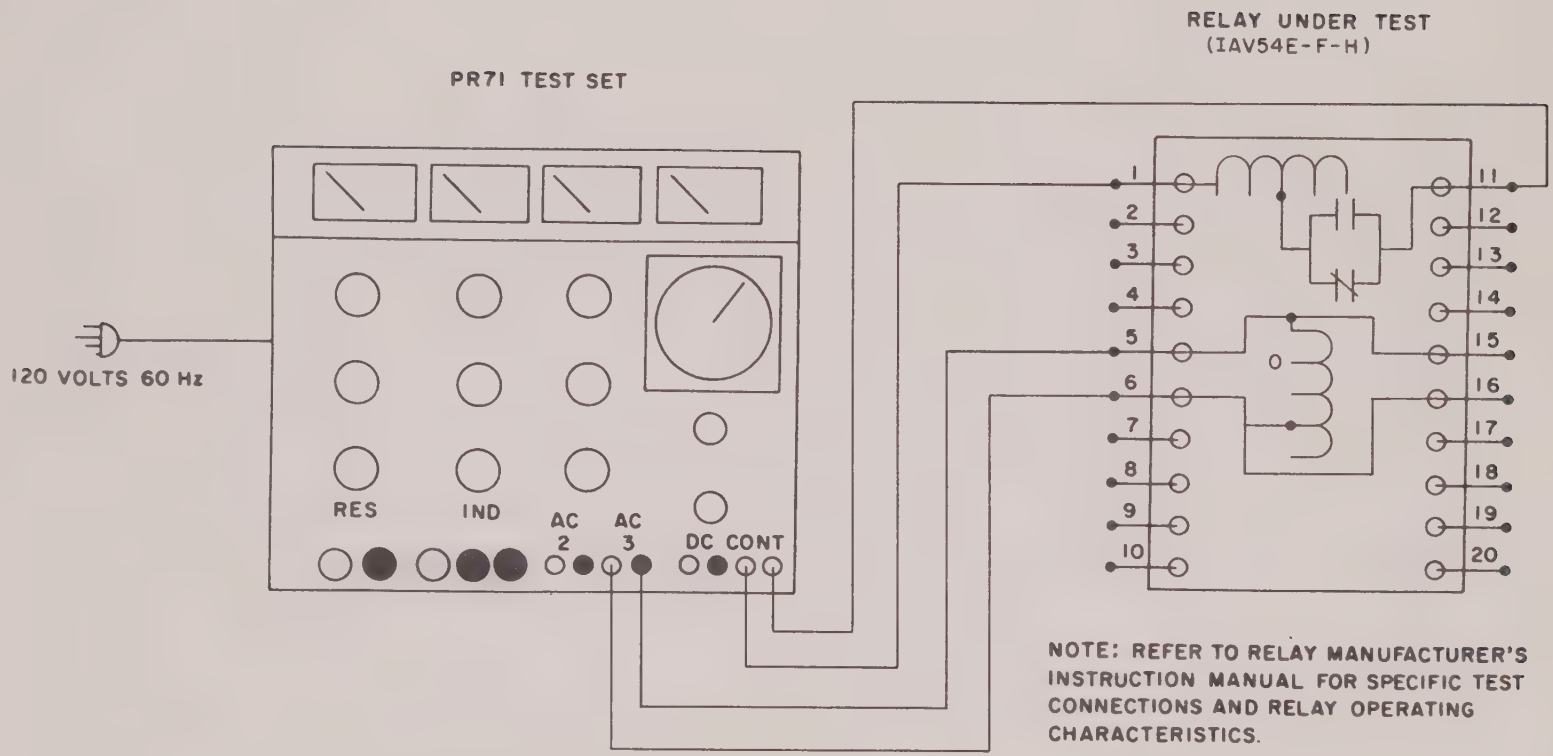
In all cases reference should be made to the relay manufacturer's instructions for specific test connections and relay operating characteristics.

In addition to testing and calibrating protective relays, the Model PR-71 Test Unit can be used as a portable power supply in many other test applications, including:

- Molded case circuit breakers
- Wire insulation resistance
- Switchboard instruments
  - AC/DC Voltmeters & Ammeters
  - AC Wattmeters
- AC/DC Recorders

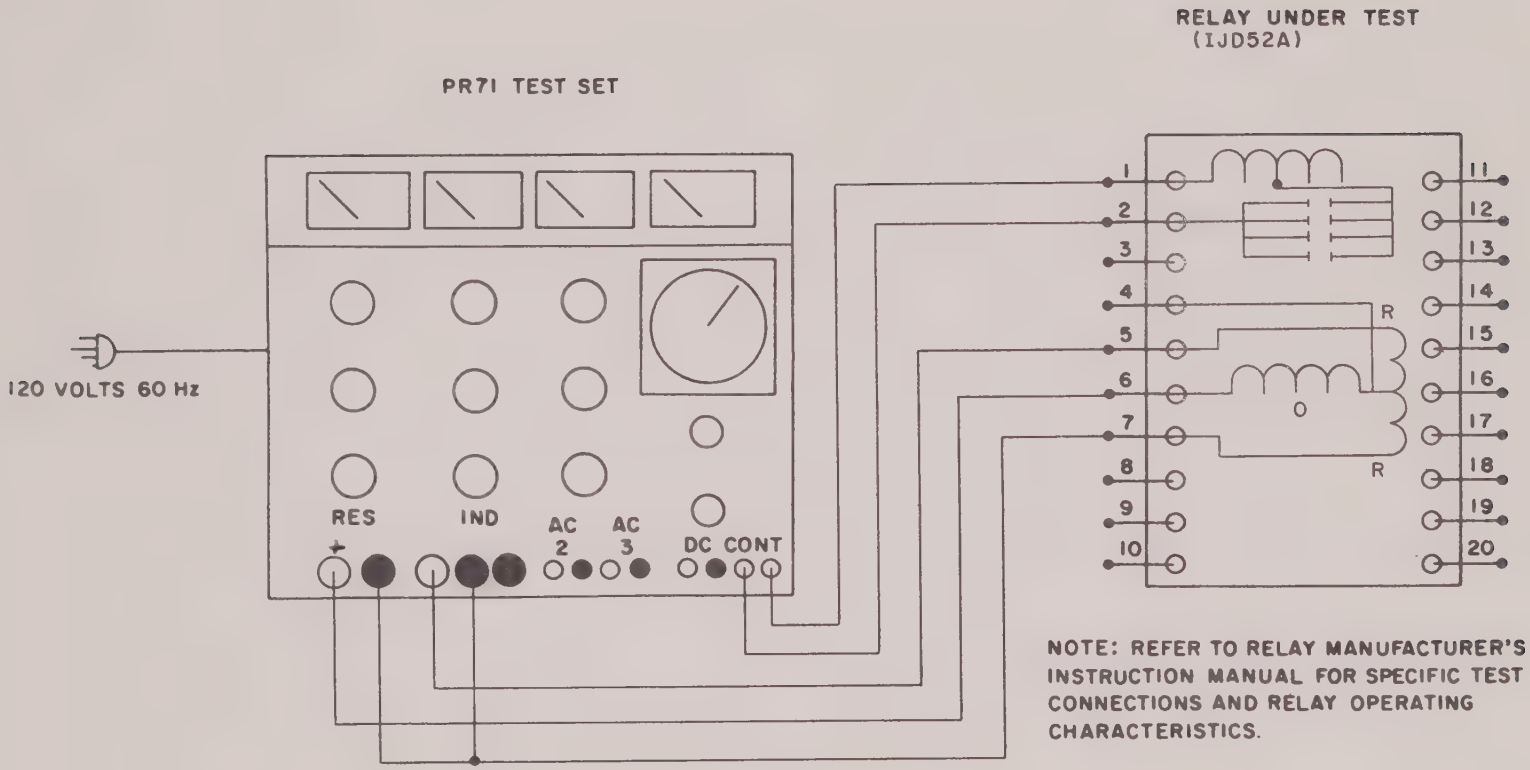
TEST SETUP

GE UNDERVOLTAGE RELAY



TEST SETUP

GE PERCENTAGE DIFFERENTIAL RELAY

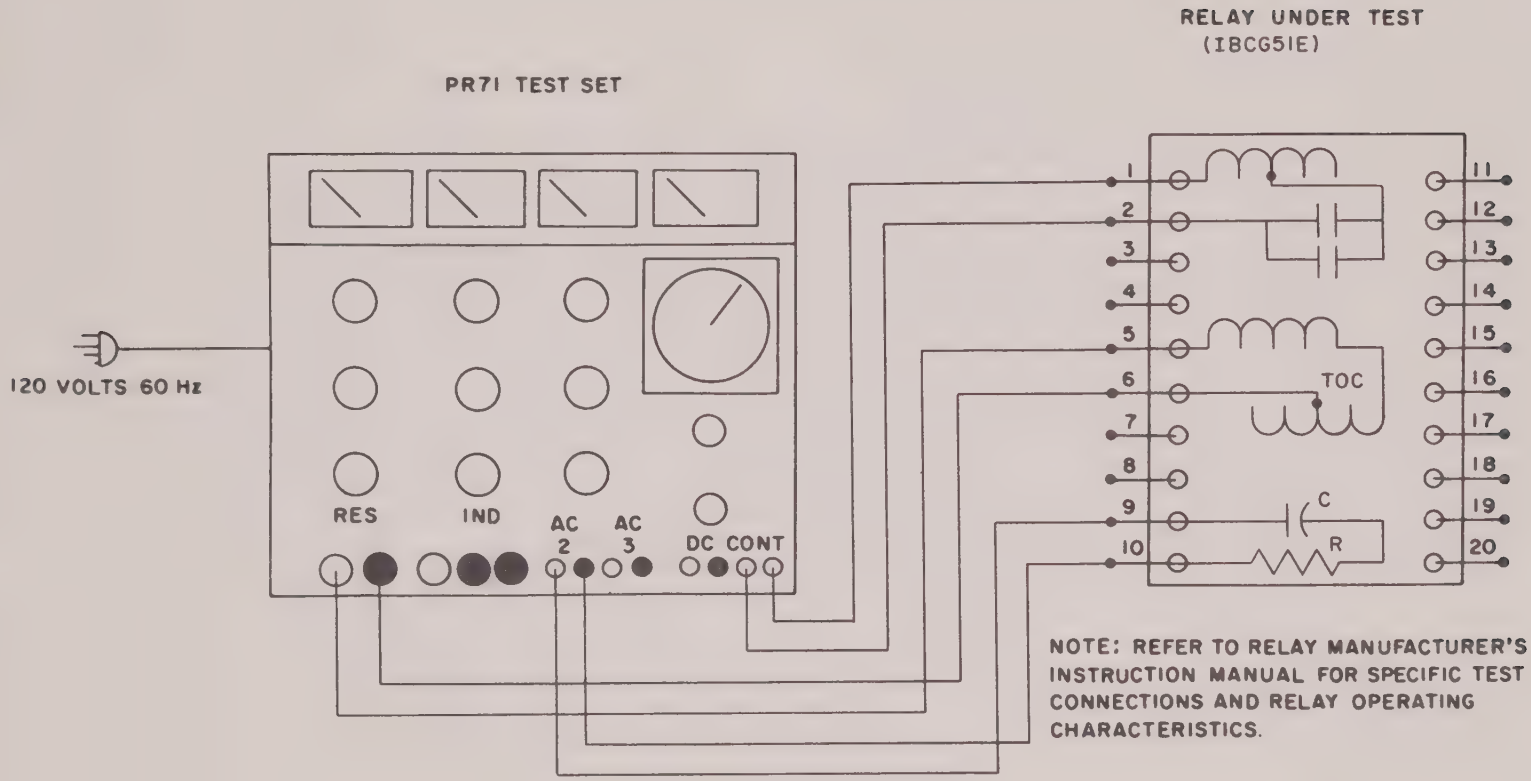


NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

TEST SETUP

G E GROUND DIRECTIONAL OVERCURRENT RELAY

TEST FOR CHECKING PICKUP & OPERATING TIME OF
TIME OVERCURRENT UNIT USING POTENTIAL POLARIZATION

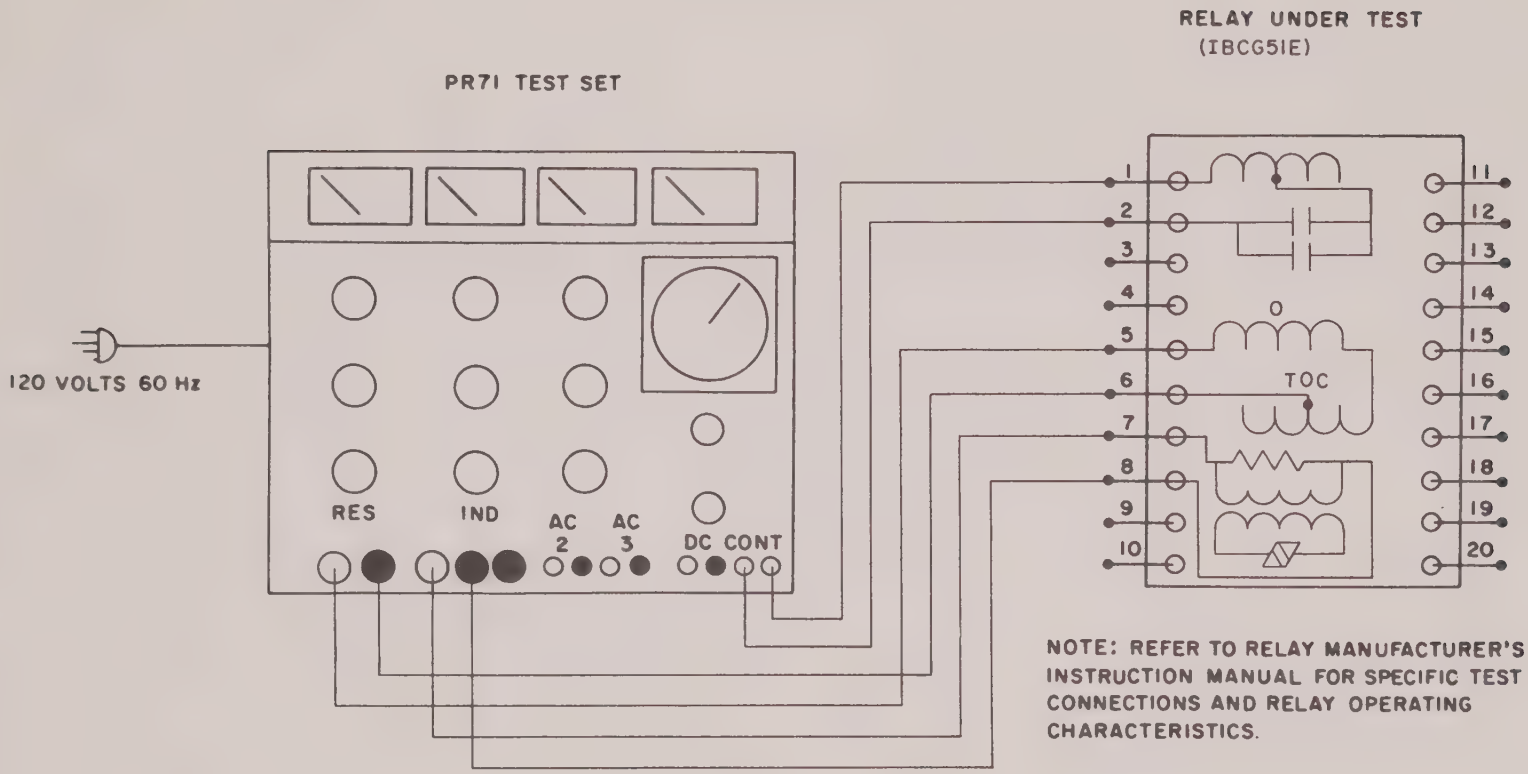


NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

TEST SETUP

G E GROUND DIRECTIONAL OVERCURRENT RELAY

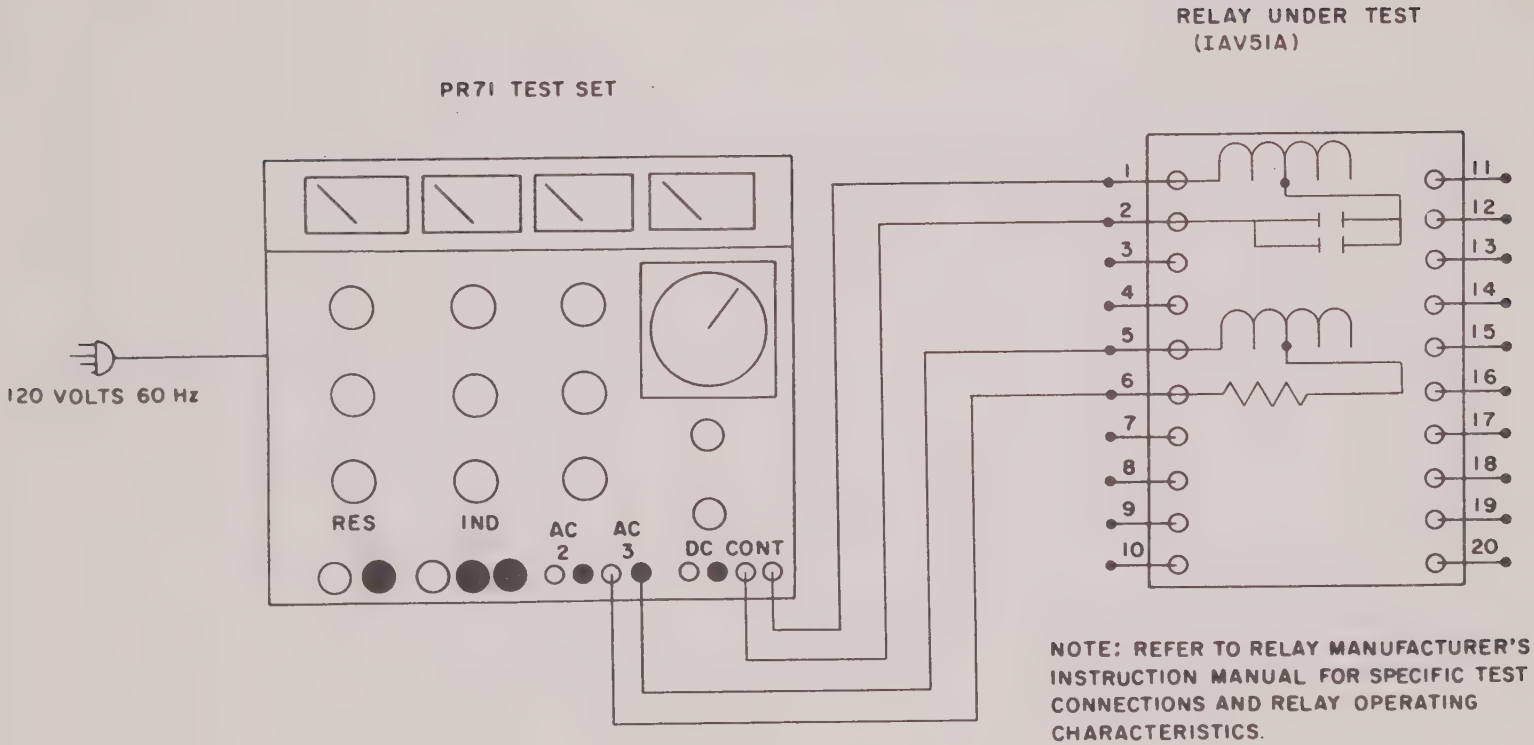
TEST FOR CHECKING PICKUP & OPERATING TIME OF
TIME OVERCURRENT UNIT USING CURRENT POLARIZATION



NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

TEST SETUP

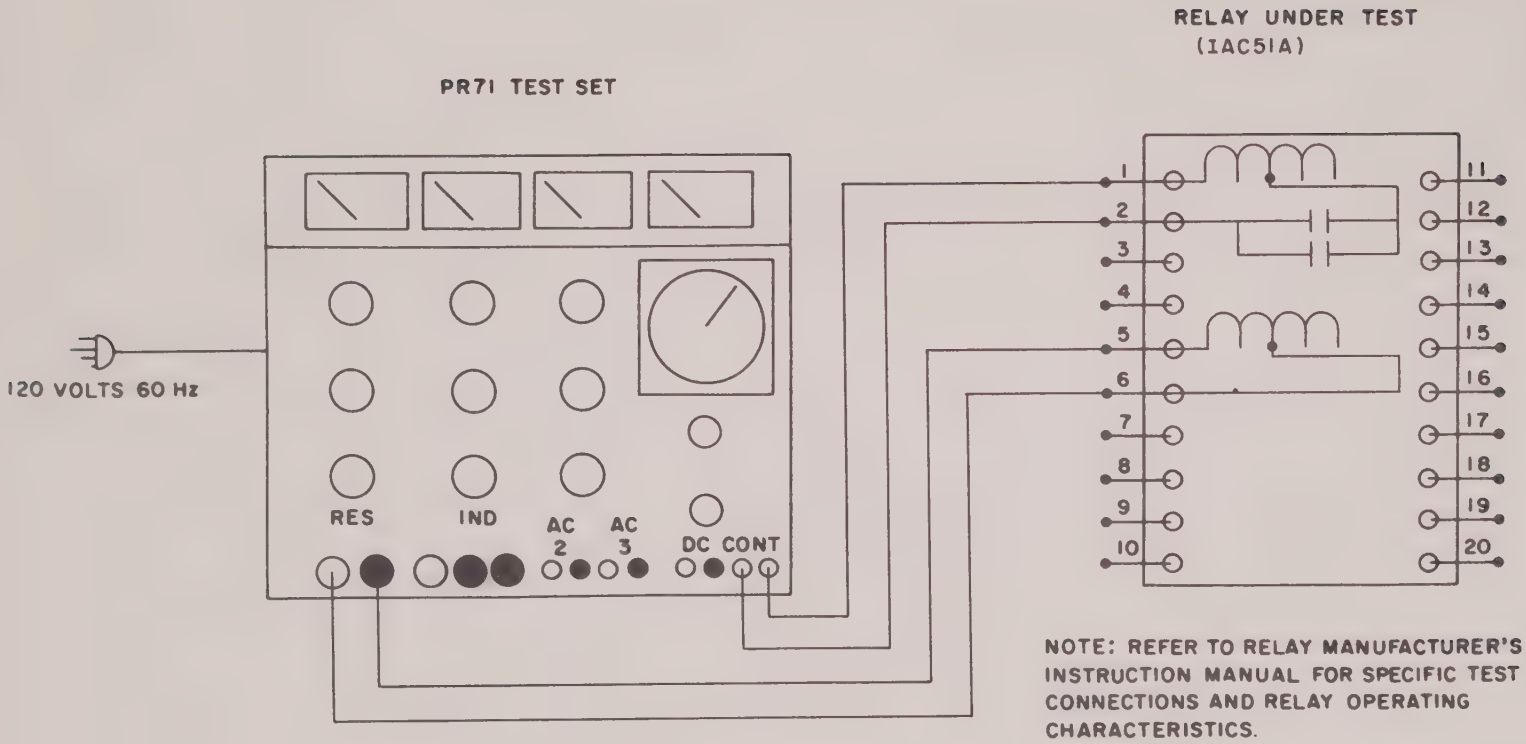
GE VOLTAGE RELAY



NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

TEST SETUP

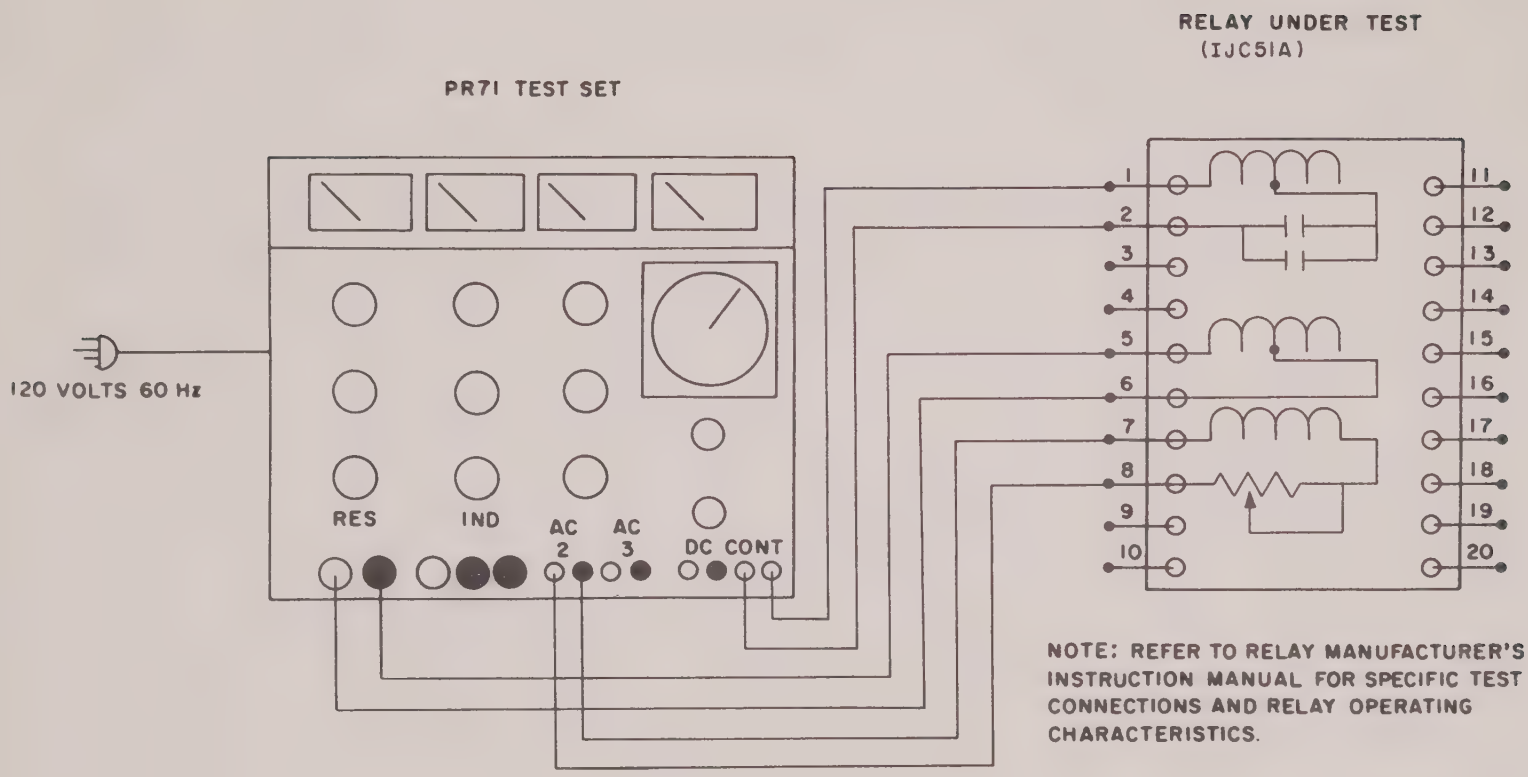
GE TIME OVERCURRENT RELAY



NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

TEST SETUP

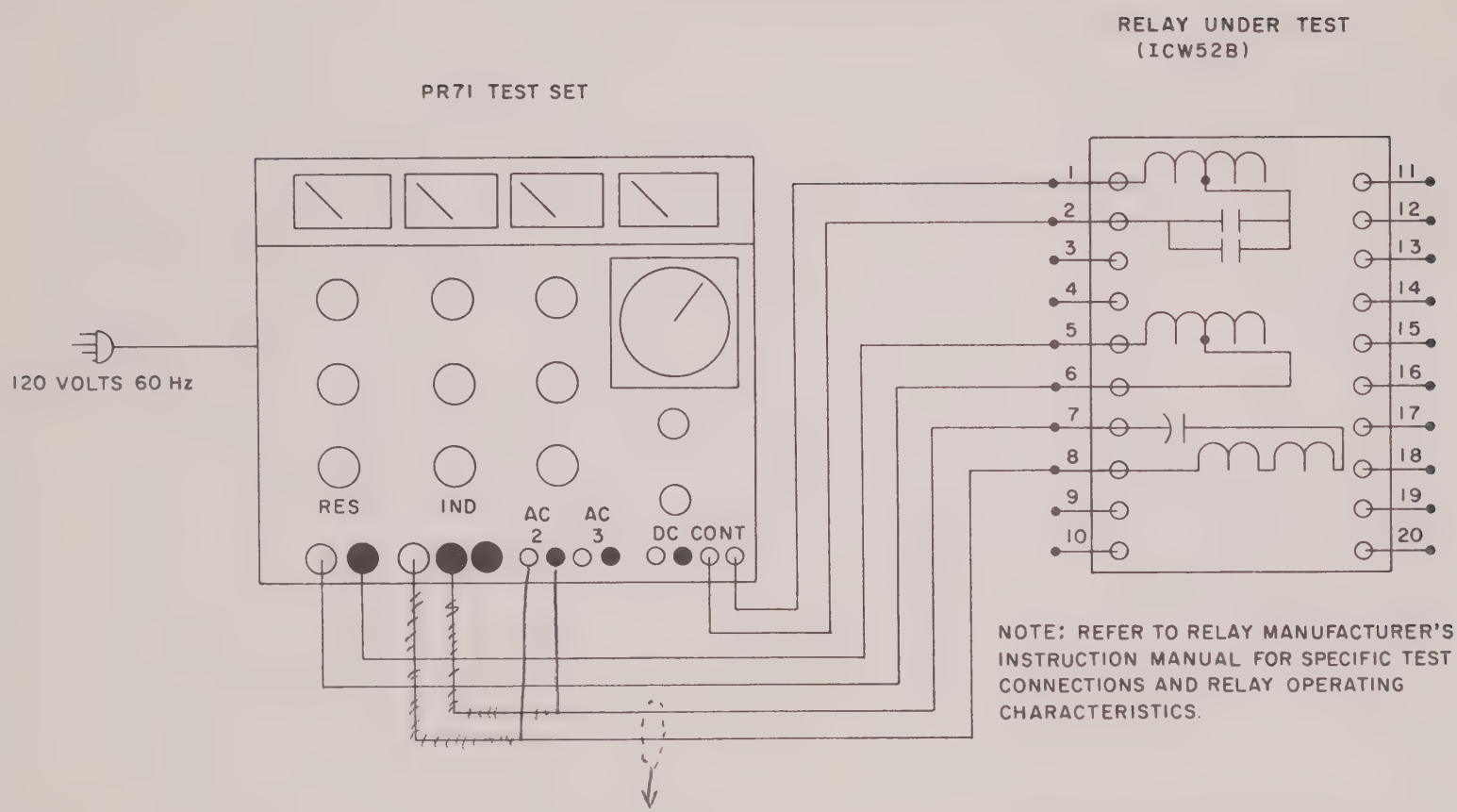
GE TIME OVERCURRENT RELAY
WITH VOLTAGE RESTRAINT



NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

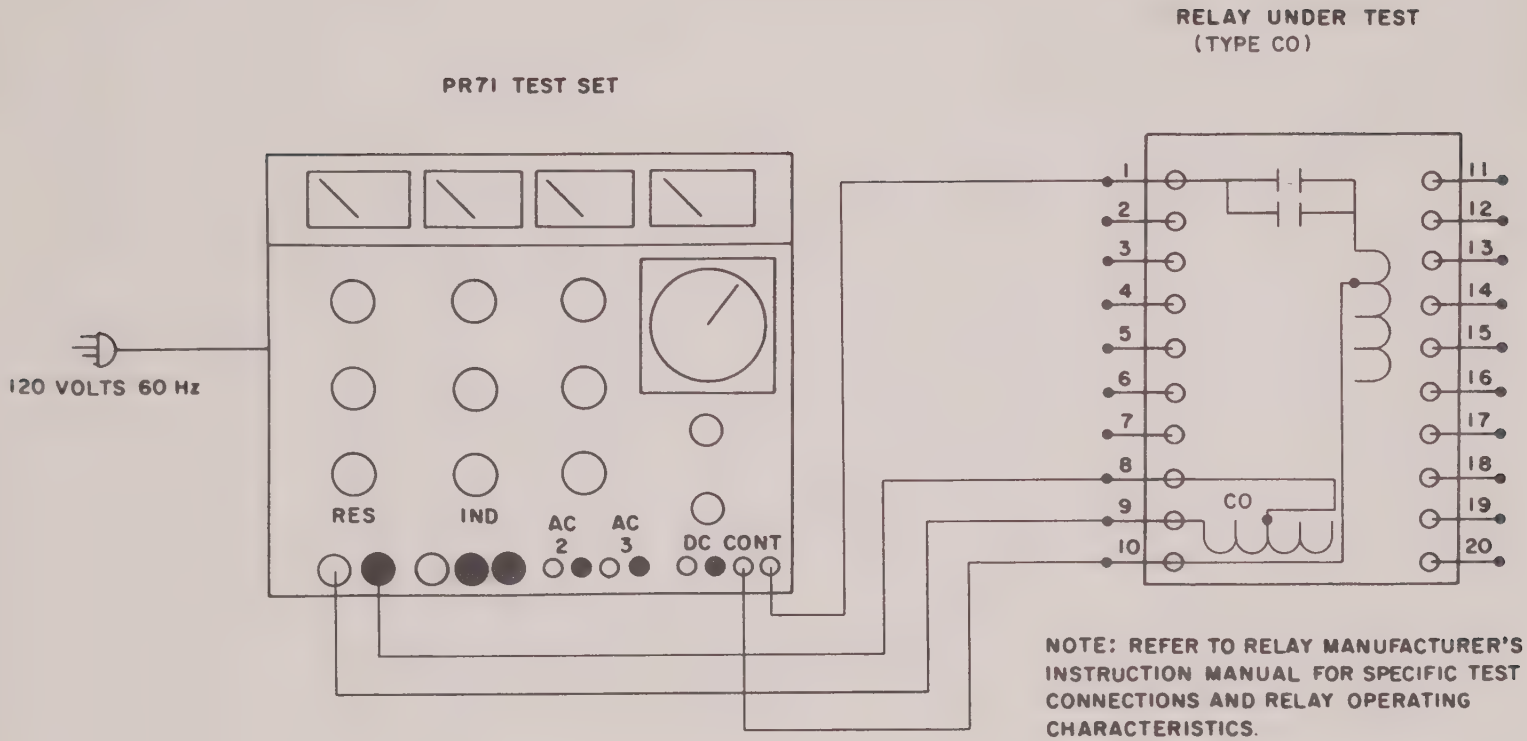
TEST SETUP

GE DIRECTIONAL POWER RELAY



TEST SETUP

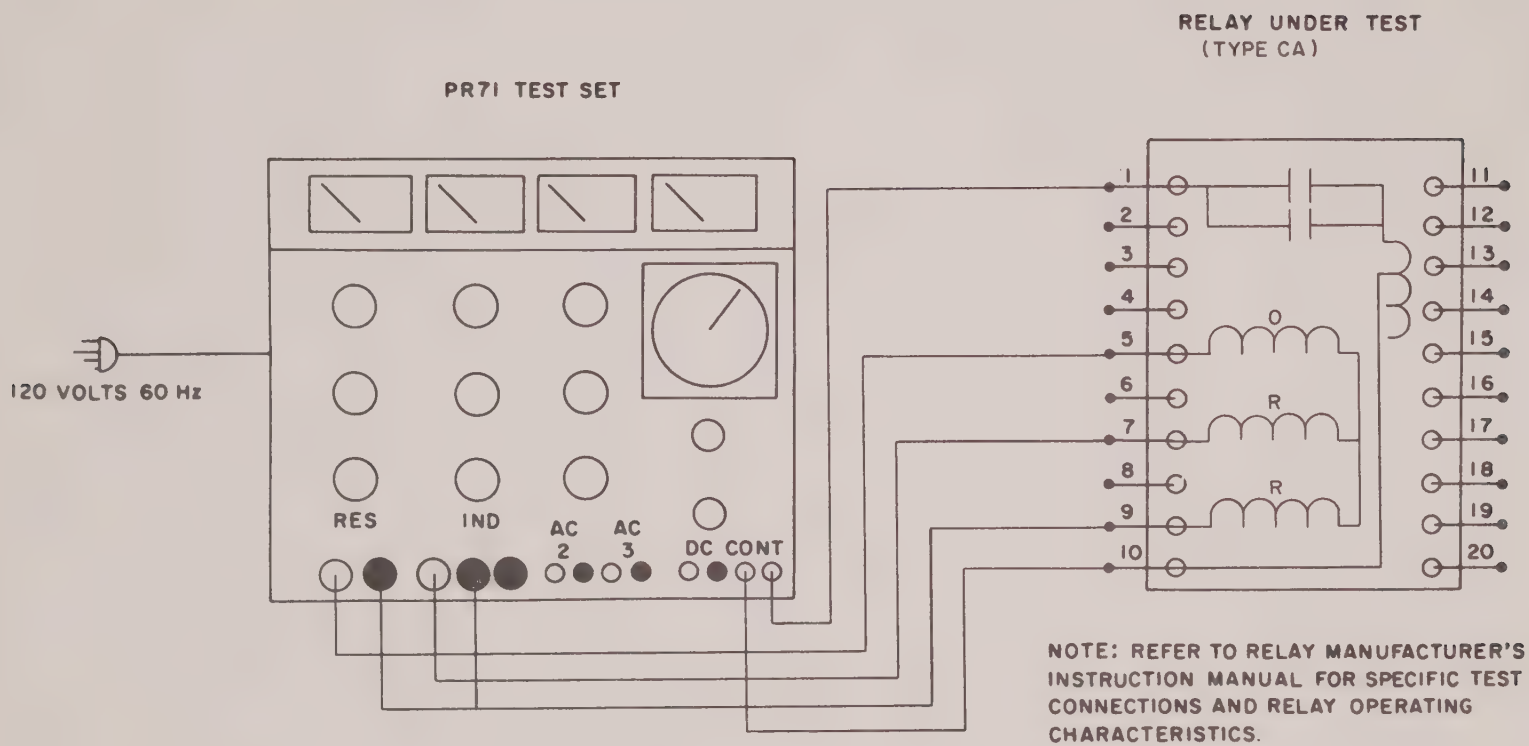
WESTINGHOUSE – TIME OVERCURRENT



NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

TEST SETUP

WESTINGHOUSE PERCENTAGE DIFFERENTIAL RELAY



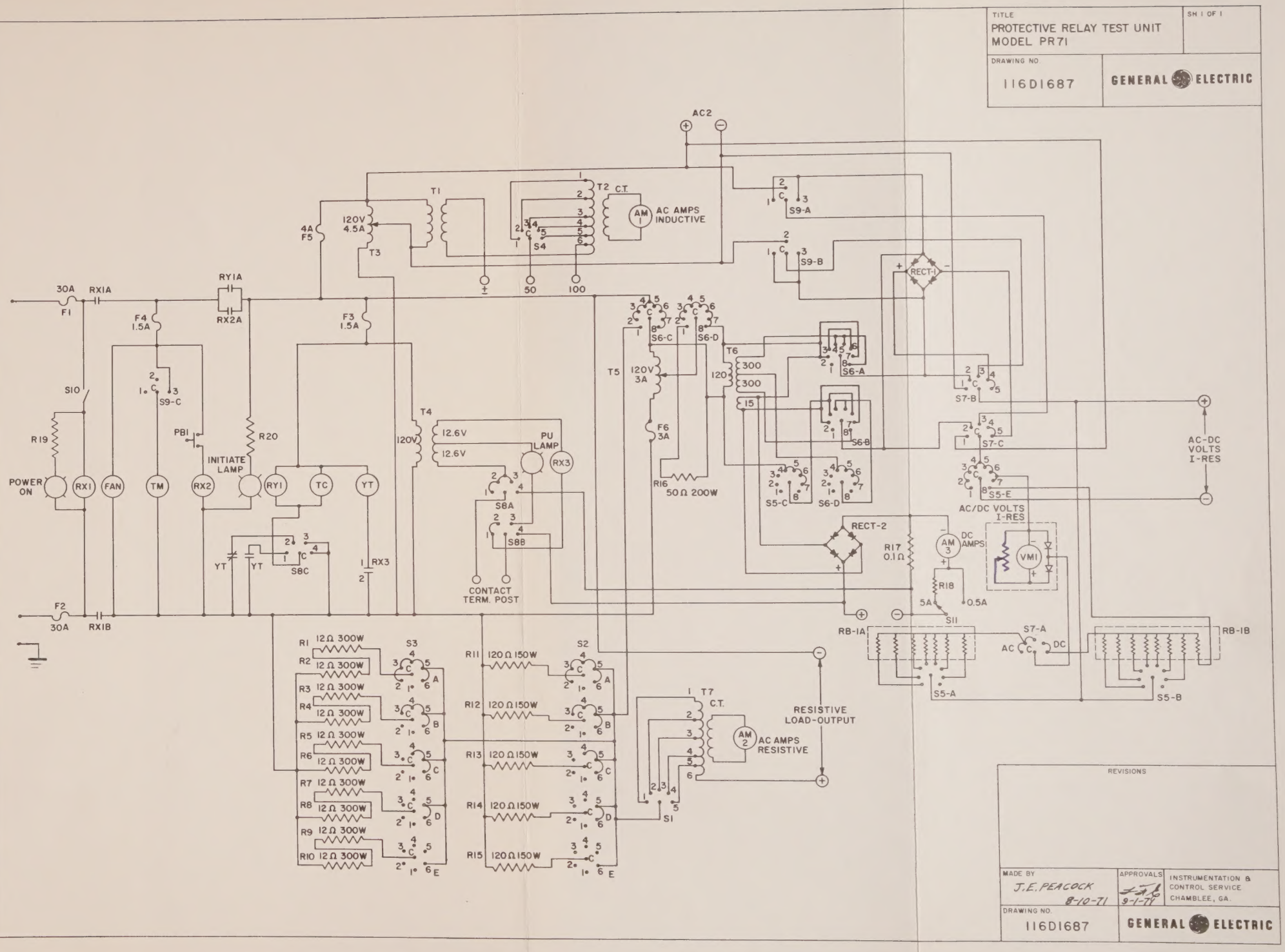
NOTE: REFER TO RELAY MANUFACTURER'S INSTRUCTION MANUAL FOR SPECIFIC TEST CONNECTIONS AND RELAY OPERATING CHARACTERISTICS.

PRINCIPAL RENEWAL PARTS LIST

PROTECTIVE RELAY TEST UNIT
MODEL PR-71

SCHEMATIC DRAWING SYMBOL	DESCRIPTION	QUANTITY USED	PART NUMBER 116D1687P**
AM1	Ammeter	1	P01
AM2	Ammeter	1	P02
AM3	Ammeter	1	P03
VM1	Voltmeter	1	P04
PB1	Lighted Pushbutton Assy.	1	P05
PU Lamp	Indicator Light Assy.	1	P06
S10	Lighted Pushbutton Assy.	1	P07
S11	Dual Pushbutton Assy.	1	P08
S1	Selector Switch	1	P09
S2	Selector Switch	1	P10
S3	Selector Switch	1	P11
S4	Selector Switch	1	P12
S5, S6	Selector Switch	2	P13
S7	Selector Switch	1	P14
S8	Selector Switch	1	P15
S9	Selector Switch	1	P16
T1	Transformer	1	P17
T2	Transformer	1	P18
T3	Transformer	1	P19
T4	Transformer	1	P20
T5	Transformer	1	P21
T6	Transformer	1	P22
T7	Transformer	1	P23
R1-R10	Resistor	10	P24
R11-R15	Resistor	5	P25
R16	Resistor	1	P26
R17	Resistor	1	P27
R18	Resistor	1	P28
R19, R20	Resistor	2	P29
RB1A	Resistor Board Assy.	1	P30
RB1B	Resistor Board Assy.	1	P31
RX1, RX2, RY1	Relay	3	P32
RX3	Relay	1	P33
YT1	Relay	1	P34

SCHEMATIC DRAWING SYMBOL	DESCRIPTION	QUANTITY USED	PART NUMBER 116D1687P**
RECT 1	Rectifier Assy.	1	P35
RECT 2	Rectifier Assy.	1	P36
	Timer	1	P37
	Receptable, Black	3	P38
	Receptacle, White	2	P39
	Terminal Post, Black	3	P40
	Terminal Post, White	5	P41
	Fan	1	P42
	High Current Leads	2	P43
	Test Leads	2	P44
	Indicator Lamp, 6 volt	2	GE #328
	Indicator Lamp, 28 volt	2	GE #327
F1, F2	Fuse	2	Type 3AG-30A
F3, F4	Fuse	2	Type 3AG-1.5A
F5	Fuse	1	Type 3AG-4A
F6	Fuse	1	Type 3AG-3A


TITLE
PROTECTIVE RELAY TEST UNIT
MODEL PR71
SH 1 OF 1
DRAWING NO.
116D1687
GENERAL ELECTRIC
AC2
T1
T2 C.T.
AM 1
AC AMPS INDUCTIVE
4A F5
120V 4.5A
T3
S4
50
100
S9-A
S9-B
RECT-1
RY1A
RX2A
30A
RX1A
F1
F4 1.5A
F3 1.5A
S9-C
S10
R19
POWER ON
RX1
FAN
TM
PB1
R20
INITIATE LAMP
RX2
RY1
TC
YT
T4
120V
12.6V
12.6V
PU LAMP
RX3
S8A
S8B
S8C
CONTACT TERM. POST
T5
120V 3A
F6 3A
R16 50Ω 200W
T6
300
300
15
120
S6-C
S6-D
S6-A
S6-B
S5-C
S6-D
S7-B
S7-C
S5-E
AC-DC VOLTS I-RES
AC/DC VOLTS I-RES
RECT-2
R17 0.1Ω
AM 3
DC AMPS
VMI
R18
5A
0.5A
S11
F2
30A
RX1B
RB-1A
RB-1B
S7-A
AC
DC
S5-A
S5-B
R1 12Ω 300W
R2 12Ω 300W
R3 12Ω 300W
R4 12Ω 300W
R5 12Ω 300W
R6 12Ω 300W
R7 12Ω 300W
R8 12Ω 300W
R9 12Ω 300W
R10 12Ω 300W
S3
R11 120Ω 150W
R12 120Ω 150W
R13 120Ω 150W
R14 120Ω 150W
R15 120Ω 150W
S2
T7 C.T.
AM 2
AC AMPS RESISTIVE
RESISTIVE LOAD-OUTPUT
S1
REVISIONS
MADE BY
J.E. PEACOCK
8-10-71
APPROVALS
9-1-71
INSTRUMENTATION & CONTROL SERVICE
CHAMBLEE, GA.
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